Chapter 8

Multimedia Devices and Mass Storage

At a Glance

Instructor's Manual Table of Contents

- Overview
- Objectives
- Teaching Tips
- Quick Quizzes
- Class Discussion Topics
- Additional Projects
- Additional Resources
- Key Terms

Lecture Notes

Overview

This chapter examines multimedia devices: what they can do, how they work, and how to support them. The student will also learn about storage devices such as CDs, DVDs, removable drives, tape drives, and external hard drives, including their installation and troubleshooting.

Chapter Objectives

After reading this chapter and completing the exercises, the student will learn:

- About multimedia adapter cards, including sound cards, TV tuner cards, and video capture cards
- About optical storage technologies, including CD, DVD, and Blu-ray
- About removable storage, including solid-state devices, external hard drives, and tape drives
- How to install multimedia peripherals and input devices
- How to install and configure multimedia and mass storage devices, including optical drives, adapter cards, and external drives
- How to troubleshoot multimedia and mass storage devices

Teaching Tips

Multimedia Adapter Cards

1. Describe the goal of multimedia technology.

2. Emphasize the difference between the way computers store data and how sights and sounds record information.

3. Introduce the topics covered in this section.

Sound Cards and Onboard Sound

1. Introduce and explain sound cards and on-board sound.

2. Describe characteristics of sound cards and onboard sound.

3. Use Figure 8-1 to illustrate a sound card.

4. Point out that the number and type of sound ports on a motherboard or sound card depends on the sound standards the card or board supports.

5. Describe various audio compression methods.

6. Use Figure 8-2 to illustrate a motherboard containing onboard sound.
7. Use Table 8-1 to describe the sound ports on a motherboard.
8. Explain what is meant by the phrase Sound Blaster-compatible.
9. Define and explain the term MP3.
10. Use Table 8-2 to provide a list of sound card manufacturers.

TV Tuner and Video Capture Cards

1. Define and explain a TV tuner card.
2. Define and explain a video capture card.
3. Use Figure 8-3 to illustrate a notebook computer with an onboard TV tuner and TV capture capability.
4. Use Figure 8-4 to illustrate an RCA cable with one end that connects to the red, white, and yellow ports on a laptop and another end that can connect to an Xbox.
5. Describe features to consider when selecting a video capture card.
6. Describe features to consider when selecting a TV tuner card.
7. Use Figure 8-5 to illustrate and describe a combination TV tuner and video capture card.
8. Use Figure 8-6 to illustrate an external device that can be used as a TV tuner and to capture video and stills.
9. Use Table 8-3 to provide a list of manufacturers of TV tuner and video capture cards.

Teaching Tip	More information on how sound cards work may be found at: http://computer.howstuffworks.com/sound-card.htm

Quick Quiz 1

1. True or False: Computers store data digitally and ultimately as a stream of only two numbers: zero and one.
   Answer: True

2. True or False: The number and type of sound ports on a motherboard or sound card depends on the sound standards the card or board supports.
   Answer: True

3. After the sound is recorded and digitized, many sound cards convert and compress the digitized sound to _____ format, which takes up less space on a hard drive.
   Answer: MP3

4. A(n) _____ card can turn your computer into a television.
   Answer: TV tuner

5. A(n) _____ card lets you capture video input and save it to a file on your hard drive.
   Answer: video capture

Optical Storage Technology

1. Introduce the primary forms of optical storage media: CDs and DVDs.

2. Note that both technologies make use of lands and pits on the disc to represent bits, which are then read by lasers.

3. Point out that CDs use one of two file systems: CDFS (Compact Disc File System) or UDF (Universal Disk Format) file system.

4. Point out that DVDs rely on UDF formats, but support CDFS for backward compatibility and that Windows supports both file systems.

5. Use Figure 8-7 to illustrate an internal DVD drive.

6. Use Figure 8-8 to illustrate an external DVD drive.

Teaching Tip	More information on Windows Vista CD and DVD file systems may be found at: http://windowshelp.microsoft.com/Windows/en-US/help/2af64e60-60aa-4d79-ab6c-3a5db5806cbe1033.mspx

How Data Is Read and Written To Optical Discs

1. Define the terms “land” and pit”.

2. Use Figure 8-9 to describe pits, lands, and layers of a CD.

3. Explain how data is read from, and written to a CD; DVD; Blu-ray disc.
   a. Emphasize the differences between the two types of laser beams.
   b. Use Figure 8-10 to illustrate the layers of a DVD or Blu-ray disc.

4. Use Figure 8-11 to illustrate the spiral layout of sectors on an optical disc surface.

5. Emphasize that to provide faithful reproduction of encoded data, CDs must be read at a constant rate. Describe a technique for enforcing the constant rate rule: constant linear velocity (CLV).

6. Mention that audio and video have different requirements.

How Much Data Can Be Stored On Optical Discs

1. Describe how much data can be held on CDs, DVDs, and BDs.

Standards Supported By CD, DVD, and BD Drives

1. Using Table 8-4, discuss three CD standards that might be used by a CD drive.

2. Using Table 8-5, discuss the DVD standards used for reading and writing.

3. Using Table 8-6, discuss the Blu-ray disc standards.

4. Point out that CD-RW, DVD-RW, DVD+RW, and BD-RE discs can be overwritten thousands of times and are considered a replacement for the older floppy disks.

Features of Optical Drives

1. Mention that optical drives can be external or internal drives.

2. Discuss considerations to take into account when selecting a CD, DVD, or BD drive.

3. Compare the two technologies used to burn labels on the top of a disc: Labelflash and LightScribe.

4. Use Figure 8-12 to illustrate a LightScribe CD-R that was just labeled using LightScribe.

5. Describe additional ways to label a disc.

Caring For Optical Drives and Discs

1. Describe the main causes of problems with CDs and DVDs: dust, fingerprints, scratches, defects, and electrical noise.

2. Point out that standing a drive on edge can also cause malfunctions.

3. Review the various precautions for handling CDs, DVDs, and BDs.

4. Use Figure 8-15 to illustrate a cleaning solution specifically designed for optical discs.

5. Use Table 8-7 to illustrate optical drive manufacturers.

Teaching Tip	More information on Blu-ray discs may be found at: http://en.wikipedia.org/wiki/Blu-ray_Disc and http://www.blu-ray.com/info/

Quick Quiz 2

1. The surface of a CD stores data as pits and _____.
   Answer: lands

2. True or False: DVD drives use the CDFS or UDF file system.
   Answer: False

3. True or False: Blu-ray drives are backward compatible with DVD and CD technologies.
   Answer: True

4. True or False: Data is written to both sides of a CD.
   Answer: False

5. In order to read each sector on the spiral at a(n) _____, the disc spins faster when the read-write head is near the center of the disc.
   Answer: constant linear velocity (CLV)

Removable Storage

1. Note that removable drives can be internal or external.

2. List the advantages of removable drives.

Solid-State Storage

1. Define the term solid-state device and provide examples.

2. Describe characteristics of USB flash drives.

3. Use Figure 8-16 to illustrate USB drives.

4. Use Table 8-8 to illustrate several types of flash memory cards on the market today.

5. Explain how to obtain drivers for USB devices and how to remove USB devices from a Windows computer system.

6. Use Figure 8-17 to illustrate the Safely Remove Hardware icon and dialog box.

7. Use Figure 8-18 to illustrate how a flash memory card may be bundled with one or more adapters, so that a smaller card will fit a larger card slot.

8. Use Figure 8-19 to illustrate a Sony digital camera that has a Memory Stick PRO slot.

9. Use Figure 8-20 to illustrate several flash memory cards together and the relative sizes of each type.

Teaching Tip	More information on removable storage technologies may be found at: http://computer.howstuffworks.com/removable-storage8.htm

Teaching Tip	More information on solid-state technology may be found at: http://www.jedec.org

External Hard Drives

1. Introduce and describe external hard drives.

2. Describe the ports external hard drives use to connect to a computer.

3. Use Figure 8-21 to illustrate a Maxtor external hard drive that holds 500 GB and uses a USB connection.

Tape Drives

1. Indicate that a tape drive provides high capacity storage at low expense.
   a. Use Figure 8-22 to illustrate a tape drive.

2. Advise students to invest in backup software for backup operations.

3. Define the term “sequential access” and explain why it is a disadvantage of using tape drives.

   a. Explain how sequential access limits the usefulness of tape drives.

4. Briefly describe two types of data cartridges: full size data cartridges and smaller minicartridges.
   a. Use Figure 8-23 to illustrate a minicartridge.

5. Review the list of common tape cartridge types.
   a. Use Figure 8-24 to illustrate a Maxell LTO Ultrium 3 data tape cartridge that can hold up to 800 GB of compressed data.

6. Review the selection criteria for purchasing tapes.

Install and Configure Multimedia Peripherals

1. Introduce the topics covered in this section:
   - Installing a digital camera.
   - Installing a media reader and writer.
   - Installing a Web camera, microphone.
   - Installing a MIDI device.

Installing Digital Cameras

1. Introduce digital cameras.

2. Describe two ways to transfer images from a camera to the PC.
   a. Use Figure 8-25 to illustrate a laptop with flash memory card slots.

3. Explain how images may be edited after being sent to the computer by using the camera's image-editing software, or another program (e.g., Adobe Photoshop).

4. Define and describe the term "Joint Photographic Experts Group" (JPEG).

5. Define and describe the term "Tagged Image File Format" (TIFF).

Installing Webcams and Microphones

1. Introduce and describe a webcam.

2. Use Figure 8-26 to illustrate a webcam.

3. Describe how to install a webcam.
   a. Use Figure 8-27 to illustrate a Windows Live Messenger session using a webcam.

Installing MIDI Devices

1. Introduce and describe the musical instrument digital interface (MIDI).

2. Distinguish MIDI from MP3.

3. Describe the MIDI port.
   a. Use Figure 8-28 to illustrate and describe MIDI ports on electronic drums.

4. Discuss the various ways to connect a musical instrument to a PC using the MIDI standards.
   a. Use Figure 8-29 to illustrate a MIDI-to-USB cable.
   b. Use Figure 8-30 to illustrate a keyboard by Yamaha that has a USB port to be used as a MIDI interface.

5. Discuss how to install software used to manage music.

Install and Configure Multimedia and Mass Storage Devices

1. Introduce the topics covered in this section.

2. Review the logon and authority requirements for Windows XP and Vista to install devices.

Installing a Media Reader

1. Define and describe a multimedia reader.

2. Use Figure 8-31 to illustrate a Hi-Speed USB card reader/writer.

3. Explain how to install an external media reader.

4. Explain how to troubleshoot the installation of an external media reader.

5. Use Figure 8-32 to illustrate and describe an internal media reader.

6. Explain how to install an internal media reader.

Installing an Optical Drive

1. Point out that internal optical drives use a SCSI, PATA, or SATA interface.

2. Use Figure 8-33 to illustrate the rear of a PATA CD drive.

3. Remind students that for EIDE, there are four choices for drive installations: primary master, primary slave, secondary master, and secondary slave.

4. Explain why a CD drive should have its own cable.

5. Emphasize that a CD drive should use the PATA motherboard connector and the hard drive should use the SATA connector.

6. Discuss available audio connectors on an optical drive and explain how they a used.

Installing an External Hard Drive

1. Describe how to install an external hard drive to a PC.

2. Explain how to use Windows Explorer to view and use the drive.

3. Use Figure 8-42 to illustrate options to control what happens when a disc is inserted.

4. Use Figure 8-43 to illustrate how Windows XP uses My Computer to tell the OS how to handle the AutoPlay feature for a CD drive.

5. Describe the backup software included with most drives.
   a. Use Figure 8-44 to illustrate one window in the backup process, where a user selects days and time to back up.

Installing a Capture Card

1. Review the general guidelines to install a video capture card.

2. Remind students to read the user manual to find out how to use the software to control the video capture card.

3. Explain how to control the recorded, or captured, input from each channel.

Troubleshooting Multimedia Devices

1. Mention that the following sections cover troubleshooting guidelines for optical drives, additional removable storage devices, and capture cards.

Problems with Optical Drives

1. Review the general guidelines to follow when a CD, DVD, or Blu-ray drive installation causes problems.

Problems When Burning a CD, DVD, or BD

1. Review the general guidelines to follow when burning a CD, DVD, or BD causes problems.

2. Use Figure 8-45 to illustrate the use of Windows Media Player to select the burn rate in Vista.

3. Use Figure 8-46 to illustrate how to slow down the CD-RW burn speed to account for a slow Windows XP system.

Problems with Removable Storage Devices

1. Review the steps to follow when a removable storage device does not work.

Problems with Capture Cards

1. Review the steps to follow when troubleshooting an adapter card.

Teaching Tip	More information troubleshooting sound cards may be found at: http://www.techadvice.com/tech/S/SoundCardTS.htm

Quick Quiz 3

1. A storage device that uses memory chips and no moving parts to store data, instead of spinning disks, is called a(n) _____.
   Answer: solid-state device (SSD) or solid-state drive

2. _____ are less expensive for backups than external hard drives, CDs, DVDs, and USB flash drives.
   Answer: Tape drives

3. _____ is a common compression standard for storing photos.
   Answer: Joint Photographic Experts Group (JPEG)

4. True or False: TIFF (Tagged Image File Format) files are smaller than JPEG (Joint Photographic Experts Group) files.
   Answer: False

5. The biggest disadvantage of using tape drives is that data is stored on tape by _____.
   Answer: sequential access

Class Discussion Topics

1. What are the primary characteristics of secondary storage devices based on solid-state technology?

2. What is the difference between the MIDI and MP3 audio encoding standards?

Additional Projects

1. Perform additional research on sound sampling. Identify and describe 3 to 5 types of distortions that can occur during the sampling process. Are there any techniques for minimizing these distortions? Provide a response in 1 to 2 paragraphs.

2. Perform additional research on MP3 (MPEG-1 Layer 3). What bit rates are available for MP3? How does the bit rate relate to the quality of playback? How is the bit rate associated with "compression artifacts"? Provide a response in 1 to 2 paragraphs.

3. The sections dedicated to CD drives placed an emphasis on the need to read and write data at a constant rate. To help achieve this goal, one of two quantities is varied: linear velocity or angular velocity. Conduct additional research to find an algebraic formula that relates linear velocity to angular velocity. What is the third quantity that appears in the formula? How does this quantity related to the actuator arm? Report your findings in 1 to 2 paragraphs.

Additional Resources

1. How Sound Cards Work:
   http://computer.howstuffworks.com/sound-card.htm

2. Image File Formats:
   http://en.wikipedia.org/wiki/Image_file_formats

3. Digital Audio Formats:
   http://www.webopedia.com/DidYouKnow/Computer_Science/2005/digital_audio_formats.asp

4. CD and DVD Technologies:
   http://www.computerhope.com/help/cdrom.htm

5. Optical Storage Technology Association:
   http://www.osta.org

Key Terms

- **Blu-ray Disc (BD)**: The latest optical storage technology. It uses the UDF version 2.5 file system.
- **card reader**: Another name for a media reader. It provides slots for memory cards and can be an internal or external device.
- **CD**: A popular storage media for multimedia data. CDs are the most popular way of distributing software.
- **CDFS (Compact Disc File System)**: The 32-bit file system for CD discs.

- **constant linear velocity (CLV)**: A CD-ROM format in which the spacing of data is consistent on the CD, but the speed of the disc varies depending on whether the data being read is near the center or the edge of the disc.
- **data cartridge**: A type of tape medium typically used for backups. Full-sized data cartridges are 4 x 6 x 2 inches in size. A mini-cartridge is only 3 x 2 x 2 inches in size.
- **DVD (digital video disc or digital versatile disc)**: A faster, larger CD format that can read older CDs, store over 8 GB of data, and hold full-length motion picture videos.
- **half-life**: The time it takes for a medium storing data to weaken to half of its strength. Magnetic media, including traditional hard drives and floppy disks, have a half-life of five to seven years.
- **JPEG (Joint Photographic Experts Group)**: A graphical compression scheme that allows the user to control the amount of data that is averaged and sacrificed as file size is reduced. It is a common Internet file format. Most JPEG files have a .jpg extension.
- **lands**: Microscopic flat areas on the surface of a CD or DVD that separate pits. Lands and pits are used to represent data on the disk.
- **media reader**: Another name for a card reader. It provides slots for memory cards and can be an internal or external device.
- **memory card reader/writer:** Another name for a media reader. It provides slots for memory cards and can be an internal or external device.
- **MIDI (musical instrument digital interface):** A set of standards that are used to represent music in digital form. MIDI is a method of digitally describing and storing every individual note played by each individual instrument used in making music. With MIDI files and MIDI software, you can choose to listen to only a single instrument being played, or change one note played by that instrument. MIDI can be used to creatively produce synthesized music, mute one instrument or voice, and edit a song with your own voice or instrument. MIDI standards are used to connect electronic music equipment, such as musical keyboards and mixers, or to connect this equipment to a PC for input and output.
- **minicartridge**: A tape drive cartridge that is only 3 x2 x inches. It is small enough to allow two drives to fit into a standard 5 -inch drive bay of a PC case.
- **MP3**: A method to compress audio files that uses MPEG level 1. It can reduce sound files as low as a 1:24 ratio without losing much sound quality.
- **pits**: Recessed areas on the surface of a CD or DVD, separating lands, or flat areas. Lands and pits are used to represent data on a disc.
- **sequential access**: A method of data access used by tape drives, whereby data is written or read sequentially from the beginning to the end of the tape or until the desired data is found.
- **solid-state device (SSD):** A storage device that uses memory chips to store data instead of spinning disks (such as those used by hard drives and CD drives). Examples of solid-state devices are jump drives (also called key drives or thumb drives), flash memory cards, and solid-state disks used as hard drives in notebook computers designed for the most rugged uses. Also called solid-state disk (SSD).
- **solid-state disk (SSD):** Another term for solid-state device.
- **surround sound**: A sound compression standard that supports six separate sound channels using six speakers known as Front Left and Right, Front Center, Rear Left and Right, and Subwoofer. Surround Sound 7.1 supports two additional rear or side speakers. Also known Dolby AC-3, Dolby Digital Surround, or Dolby Surround Sound.

- **TIFF (Tagged Image File Format)**: A bitmapped file format used to hold photographs, graphics, and screen captures. TIFF files can be rather large, and have a .tif file extension.
- **TV tuner card**: Can turn your computer into a television.
- **UDF (Universal Disk Format) file system**: A file system for optical media used by all DVD discs and some CD-R and CD-RW discs.
- **video capture card**: Lets you capture this video input and save it to a file on your hard drive.